GEORGE M. WOODWELL

SCIENCE, CONSERVATION AND GLOBAL SECURITY[1]

A NEW WORLD

We live in a new world in which there is no time or space for war or the threat of war.[2] This new world is beset by a series of global environmental crises that have every sign, if neglected, of being as destructive of civilization and the human future as the nuclear Armageddon we have spent half a century and the world's wealth and time avoiding. There is an immediate need for a relaxation and ultimate elimination of dependence on oil and other fossil fuels for both political and environmental reasons. There is a parallel need for a universal effort to restore the physical, chemical and biotic integrity of the biosphere before biotic and economic impoverishment overwhelm us.

The barbarism of the 11th of September revealed suddenly just how small our world is. And, just as abruptly, we discovered that civilization will prevail only as a result of unified purpose in providing the same security we have enjoyed in the western world to all the nations and among all as individuals. I believe that "peace and security require that all three legs of government function properly: the political system with all its checks and balances, the economic system with the full panoply of regulation it requires, and now, in a world of rapidly intensified demands on all resources, the environmental scientific system."[3] This caveat applies not just for the United States but also for all nations in this now crowded world.

Tony Blair's early October 2001 address to the British Labour Party called for an aggressive response to terrorism but also, more significantly in the long run, he sought to advance a political agenda for the new millennium designed to acknowledge and correct the gross disparities in human welfare around the world: the crisis of Africa, the urgency of economic reform to reverse the polarization of wealth, and the necessity for ratification of the Kyoto Protocol. The lesson was most unfortunately lost on the United States, which cast a cloud over the decennial Earth Summit held in Johannesburg in late August and early September of 2002 by refusing to participate at all if climatic disruption were on the agenda. In doing so the U.S. administration revealed itself as thoroughly committed to prolonging the

[1] Adapted from the acceptance speech for the 2001 Volvo Environmental Prize, October 2001, Gothenberg, Sweden.

[2] Woodwell, "World enough and time?"

[3] Ibid.

A. W. Galston and C. Z. Peppard (eds.), Expanding Horizons in Bioethics, 221-232.

fossil fuel age despite the political and environmental consequences discussed below. Margaret Beckett, Secretary of State for Environment, Food and Rural Affairs in the U.K., added her vivid insights to the ringing challenge from Blair:

> The devastating tragedy which overshadows this conference and all our lives is a sharp reminder of how much we are one world. It reminds us, as Tony [Blair] said recently, that the most basic of human rights is the right to life. But it reminds us too that the existence and the enjoyment of a right to life depend on having the means to sustain that right. It means having air you can breathe, water you can drink, food that's safe to eat.... But the recognition of climate change and its effects has brought much wider understanding of our mutual vulnerability, as people of one planet. It's brought a recognition that we have to take into account the impact of what we do and can do in one part of the globe on what we do and can do in others. The clearest evidence of that wider recognition was displayed in Bonn in July. Ministers from across the world commented with awe on the unprecedented and historic nature of the agreement made... 180 countries signed up to the practical implementation of the climate change programme whose wider principles were agreed at Kyoto. All had to give for any to gain. And we all did... And because we reached agreement in Bonn, we can move on, to push for ratification—and entry into force—of the Kyoto protocol. [4]

It is clear now that the world must move quickly not only to implement the Protocol, as will soon occur without the U.S., but also to move well beyond it to advance renewable energy globally. The topics of Protocol ratification and renewable energy were the subject of vigorous discussions by the large non-governmental community present at Johannesburg. The vigor and strength of the non-governmental meetings made it clear that the tepid governmental discussions, dominated by U.S. apostasy on all environmental matters, were incompetent and largely irrelevant.

In a political climate dominated by bellicosity in response to September 11th, concerns about global ecology and the human-caused disruption of climate and destabilization of environment may seem trivial. But we are in a new world, new not only in its potential for global terrorism, but also new in human potential for good and ill; in the speed and flow of information; in concepts of right and wrong; in concepts of government; in the hopes and expectations of the public; and in the concerns of our political leadership. We have watched the tragic consequences of the hijacking of our airliners for murderous purpose, and we are clear that there are no limits to the antagonism aimed our way. While we cannot allow that event, and the obvious threat of more to come, to pass unchallenged, neither can we allow our response to amplify the vandals' destruction. Our reaction must not hijack the planet into a suicidal plunge into global war. Nor can we allow negligence to produce a suicidal plunge of only slightly longer duration by deflecting or stopping progress against the global threats of climatic disruption and biotic impoverishment.

[4] Beckett.

HOPEFUL STEPS: THE FRAMEWORK CONVENTION ON CLIMATE CHANGE AND THE KYOTO PROTOCOL

In recognition of the threats to human welfare presented by human-induced global climatic disruption, world political leaders at the United Nations Earth Summit meetings in Rio de Janeiro in 1992 signed the U.N.-drafted treaty known as The Framework Convention on Climate Change. That treaty deals with a global problem that is more complicated technically, scientifically and politically than any previous treaty. It says, in sum, that it is the intention of the nations to stabilize the heat-trapping gas content of the atmosphere at levels that will protect human interests and nature. The Treaty was later ratified by more than 180 nations, including the United States, and thereby became global law. The 1997 Protocol to the United Nations Framework Convention on Climate Change was drafted in Kyoto to implement the Treaty. In 2004 the Protocol is still en route to ratification and implementation.[5]

Under the 1997 Protocol, the nations agreed to a complicated formula that would reduce the emissions of the industrialized world about 5% below 1990 levels by the period 2008-2012. The initial reductions were accepted by the industrialized nations, who were the principal polluters. The developing world was not included in the reductions. The United States participated intensively in the preparation of the Kyoto Protocol, which was written substantially to accommodate U.S. interests.

Our sudden withdrawal of support from the Protocol in the first few months of the George W. Bush administration was an astonishing and irresponsible reversal of U.S. policy. While that administration advanced a "program" for nominally addressing the requirements of the Convention, replacing the Protocol, the program actually called for an increase in the use of fossil fuels above current levels, not the reduction below 1990 use agreed to by the U.S. in negotiating the Protocol in Kyoto in 1997.

The United States' withdrawal from the treaty is the greater scandal in that it was the U.S. scientific community that defined the problem of climate change and made it a global public issue. In fact, the effort by the scientific community to put the issue before governments, successful as it has been, had an incubation period reaching back more than three decades to the preparations for the 1972 Stockholm Conference on the Human Environment. At that point, the scientific community acknowledged the problem of the accumulation of heat-trapping gases in the atmosphere; but they saw no measurable change in the temperature of the earth and decided (strangely and over objections from some) that there was no clear basis for recommending action to stop the trend. Instead, the issue was merely discussed and redefined. It took nearly another decade for the issue to gain attention in political circles when, in 1979, the scientific community, with help from the Council on Environmental Quality in the Executive Office of the President, provided sufficient public pressure that Congress held hearings on the threat of climatic disruption.[6]

[5] For the Protocol to become effective without U.S. participation, Russian ratification is necessary. In mid-2004 Russian ratification seems imminent.

[6] At the request of J.G. Speth, then Chairman of the Council on Environmental Quality in the Carter Administration, a statement was prepared calling attention to the seriousness of the threat of global

Despite those hearings, and others that followed, there was no concerted governmental response for another decade. In 1991-1992 the Framework Convention on Climate Change was drafted (at the Earth Summit) in response to a directive by the U.N. General Assembly, which was responding to the concentrated efforts of the scientific community. And it is the scientific community that has held steadfastly ever since to the objective of implementing the treaty.

Steps toward implementation were finally taken in 1997 in Kyoto and formulated in the Kyoto Protocol, described above. While the United States objected to the exclusion of developing countries from emissions standards, experience has shown that the developing world is moving even more effectively than the developed world toward meeting the objectives not only of the Protocol but also the Convention.[7] It is not surprising to discover that solar energy offers shortcuts to economic development in nations such as India and China, and that it can displace oil and coal and the technology associated with fossil fuels under many circumstances.[8] These steps have been taken effectively despite the tortured logic and outright lies of segments of the fossil fuel industry and its allies, and the stunning stupidity of the reversal of the U.S. position in rejecting an agreement painstakingly negotiated among the U.S. and more than 180 other nations.

Yet even the Kyoto Protocol is not enough.[9] The Protocol reflects the negotiations among the nations assembled in Kyoto in 1997. It offers a very small increment toward what is required to meet the details of the Treaty. It bows not at all to what scientists have been saying for more than two decades about the seriousness of the effects of a continued buildup of heat-trapping gases in the atmosphere.[10] It delays until 2008-2012 achievement of a reduction of 5% below 1990 emissions of carbon dioxide. Stabilization of the heat-trapping gas content of the atmosphere, as required under the Framework Convention, would involve a reduction of emissions of 50-60%, and the percentage reduction required is rising annually. The current atmospheric burden of about 379 ppm carbon dioxide (for the year 2004) is beyond levels at which scientists are confident that they can anticipate the effects. Allowing the burden to drift higher only amplifies the problem, raising further questions as to rates of sea level rise, the intensity and locales of climatic disruption, and the implications for climate and virtually all other aspects of the human habitat. The melting of the sea ice in summer in the Arctic Ocean is only one example—which turns the Arctic Ocean into an energy-absorbing black body, instead of a reflective white body under the continuous summer sun. That change is underway and far advanced.

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climatic disruption. See Woodwell et al., "The Carbon Dioxide Problem." The statement was circulated widely by the Council under Mr. Speth's leadership and became the basis for hearings before the Senate Committee on Public Works.

[7] Ramakrishna and Jacobsen, eds.

[8] See David Goodstein's essay, "Running Out of Gas," for a more detailed discussion of the sustainability of different sources of energy. *Ed.*

[9] See, e.g., Stewart and Wiener.

[10] Woodwell et al., "Biotic Feedbacks."

CLIMATIC INSTABILITY AND ENVIRONMENTAL IMPOVERISHMENT: CORE ISSUES

The consequences for climates of an increased carbon dioxide atmospheric burden are virtually unpredictable, beyond instability. The effects can be as fully devastating as war. The current, continuing, drought in North America and central Asia is consistent with long-standing predictions of the continental effects of the climatic disruption, although proof of cause and effect is never perfect in such matters. Several million people in central China are threatened now with starvation due to the prolonged drought, precisely the type of change in climate and effects anticipated as the earth warms and continental centers dry out.[11]

The instability of climate is but one of several environmental trends, each of which individually has the capacity to disrupt civilization—no less than the threats of war and political chaos that regularly grip the world. The fact is, however, that these trends are underway and the processes are far advanced. Unchecked, they lead inexorably to the biotic impoverishment of the earth,[12] to the economic impoverishment of all, and to political chaos. As destructive environmental effects progress, they quickly multiply the difficulties of maintaining stable and effective governments that are capable of reversing the trends and preserving both human welfare and the opportunity for a working democracy.

The causes of environmental impoverishment are well known:

The Growth of the Human Population

The earth now has a human population of about 6.3 billion. It is increasing annually by about 85 million, which equals an increase of one million people every 4 days. The growth in human numbers places new pressures on land, forests, fisheries, and governments from all sides. These pressures result in political unrest, as increasing numbers of people seek to migrate from poverty to wealth, from tyranny to democracy, from squalor to order. Indeed, never have there been so many migrants across so many borders, including the southern frontier of the United States, the Mediterranean frontier of Europe, and the Pacific borders of China. The United States has been an especially desirable objective, of course, with our stable democratic government and our high standard of living.

But the world is far from helpless in addressing the core issues of population. A very wise major advance was made toward the empowerment of women as a fundamental step toward population control at the Cairo Conference of 1994, which declares that

[11] Intergovernmental Panel on Climate Change, *Climate Change 1995.* See also information provided by the UN Convention to Combat Desertification, www.unccd.int; and The Earth Policy Institute, which has recently issued statements about desertification, available at http://earth-policy.org/Updates/Update23.htm.

[12] See Chapter 4 in Woodwell, *Forests in a Full World.*

> [t]he key to this new approach is empowering women and providing them with more choices through expanded access to education and health services, skill development and employment, and through their full involvement in policy- and decision-making processes at all levels. Indeed, one of the greatest achievements of the Cairo Conference has been the recognition of the need to empower women, both as a highly important end in itself and as a key to improving the quality of life for everyone.[13]

Further advances are possible, if we have the will.

Biotic Impoverishment

We hear about the loss of species, an irreversible change in the global potential for support of life. But long before species are lost, the natural communities that have dominated every corner of the earth have been impoverished to the point of dysfunction. Forests have been reduced to shrublands; shrublands to grassland and persistent herbs; grassland to wasteland or to barren ground. With those changes come dysfunctional landscapes, silted and poisoned rivers, floods and droughts, eroded landscapes and poverty. Parallel impoverishment marks the transitions in aquatic systems from those supporting large-bodied, slowly reproducing plants, fish and mammals to those supporting small-bodied, rapidly reproducing invertebrates and plankton, including toxic forms.[14]

We need not look far for examples. Haiti, the most impoverished nation in the western hemisphere, has less than 3% of its land remaining in forest, row-crop agriculture on 30+ degree slopes, no reliable public water supply, no irrigation despite extensive water works once engineered by the French and others, and abysmal poverty. A government requires a place to stand, resources to work with, not a gridlock of impossible environmental problems. The recent insurgencies and political instabilities in Haiti only emphasize this point. The only solution here is outside help, far beyond the 30% of food supplied through USAID. If we are bold enough and wise, it will require 10–50 billion dollars over a decade or more to implement a plan acceptable to the public for restoration of a landscape that can support people and a government. The landscape must have reliable rivers that flow in defined channels, forested mountain slopes that are stable, fisheries that have recovered from the effects of massive siltation, and a viable agricultural system on the best agricultural land reclaimed from under municipalities and slums.[15]

Without outside help, there is no way that such a transition can proceed in time to aid current generations of people. We cannot allow other nations and the world itself to slip into such disarray, but the process is underway and conspicuous in

[13] United Nations Population Fund.

[14] There is a large and somewhat misleading literature on biodiversity and its importance to human welfare. See for instance, Wilson, *The Diversity of Life*; and Wilson and Peter, eds., *Biodiversity*. The emphasis on biodiversity is misleading because biotic impoverishment precedes the extinction of species and is the cause of environmental breakdown and human impoverishment. The extinction of species follows if the impoverishment is prolonged and widespread.

[15] The perspective on Haiti has been compiled over years from personal experience with the U.S. Department of State, reports of USAID, World Bank and other economic development agencies as well as limited experience with Haitian officials in Haiti.

virtually every nation. There is no help for the world on the moon, or on Mars. We have to help ourselves, and the time is now.

Toxification

Human activities are changing the chemistry of the whole earth. The global carbon, nitrogen and sulfur cycles are intrinsic to all life and are now dominated by human activities.[16] The disruption of the carbon cycle is the basis of the climatic disruption. The massive changes in the nitrogen and sulfur cycles are causes of the pollution and ultimate impoverishment of terrestrial and aquatic plant and animal communities worldwide. In addition to these disruptions of the natural cycles to which all life is adapted, modern industry has produced and released into the biosphere millions of tons of exotic molecules, many of which, such as DDT, have been used because of their biological effects and have now become virtually ubiquitous. Their toxic effects reach far beyond their original purpose and contribute to the poisoning of land and water globally. Indeed, DDT and allied toxins used in agriculture and public health to control vectors of diseases have become an intrinsic part of virtually all life. This is true on a global level. The effects are profound and range from cancer and metabolic and developmental anomalies in individuals to the biotic impoverishment of land and sea.[17]

Climatic Disruption Caused by Global Warming

The most powerful evidence of the failure of the human habitat is the global destabilization of climates by the accumulation of heat in the atmosphere. The facts have not changed fundamentally since 1889, when Svante A. Arrhenius famously recognized that carbon dioxide exerts a warming effect on the global atmosphere. He predicted that doubling the atmospheric levels of carbon dioxide would result in a five to six degree (Celsius) temperature increase globally. The effect of global warming is open-ended in that it will continue until substantial reductions are made in the global use of fossil fuels. The effect is also a positive feedback system: the warming speeds the warming by slowing the absorption of carbon dioxide into the surface water of the oceans and by speeding the release of additional carbon dioxide from organic matter stored in soils and in peat.

But contrary to concerns during Arrhenius' time, the issue now has a political focus: how to achieve the stabilization of the composition of the atmosphere at a

[16] These topics have been treated in various texts in ecology, such as that of Schlesinger, *Biogeochemistry: An Analysis of Global Change*. These issues continue to be the subject of significant research around the world.

[17] The literature documenting the ubiquity of a global contamination is extensive. One of the most persuasive studies of a locally contaminated food web is that defined for eastern Long Island, NY, where spraying with DDT had been done for years to control the salt marsh mosquito. DDT residues appeared at close to acutely lethal concentrations throughout the food web. See Woodwell, Wurster, and Isaacson, "DDT Residues." For a case of the effect of pesticides and other industrial effluents on reproduction, see Steingraber, *Having Faith: An Ecologist's Journey to Motherhood*.

level that will protect human interests and nature as agreed to under the U.N. Framework Convention on Climate Change. That level is probably closer to 300 ppm than to the 379 ppm of 2004. Stabilization at the present concentration would require a reduction in present emissions globally of 3 to 4 billion tons per year of the approximately 8 billion tons currently released from all sources. Such a reduction would entail either a 60% reduction in fossil fuel use immediately or a 50% reduction and a complete cessation of deforestation for agricultural purposes. The reductions would be followed in subsequent years by a need for further reductions over a few decades to a century leading to the ultimate elimination of fossil fuels as a source of energy.[18]

ANALYSIS OF TRENDS AND THE CONCEPT OF THE BIOSPHERE

The question of what effects these trends will entail is much debated. A heavy reliance on models that incorporate physiological responses to the increases in carbon dioxide in the atmosphere produces a most optimistic view of a world with increased accumulation of carbon in lush communities that migrate with climate.[19] Others, including this author, offer a somewhat less stereotyped analysis based on experience and a consideration of a wider range of factors not easily incorporated into models.[20] That analysis shows a series of transitions more akin to the biotic impoverishment discussed above as morbidity and mortality of dominant trees affect forests, insect outbreaks become common, and other pathogens flourish in stressed plants. Data and experience are abundant[21] and more accumulate daily as drought and fires spread across the northern hemisphere continents.

These trends, as seriously threatening as they are, point to one essential transition that might emerge from this most frightening moment in human affairs. It is the recognition that civilization, i.e. the entire advance of the human enterprise globally over the three million years or so of recent human evolution (especially including the most recent 10,000 years of gradually accumulating historical record), has depended on the integrity of function of an environment hospitable to human life, best characterized as "the biosphere." I use the term inclusively to reach to the limits of life on earth, from the stratosphere (which may contain microbial spores, the dust of life), to the limits of life in the depths of the earth. This concept of the biosphere was used by G. Evelyn Hutchinson, by me, and by others in a well-known September 1970 edition of the *Scientific American* devoted to that topic under that title.[22] The most essential feature of the biosphere is that it is a living system maintained by life processes themselves. The reality and importance of that observation is conspicuous now in the accumulating global failure of that system.

[18] Intergovernmental Panel on Climate Change, "The Scientific Basis."

[19] United States Global Change Research Program, National Assessment Synthesis Team.

[20] See the essay in this volume by David Ehrenfeld, entitled "Unethical Contexts for Ethical Questions," which discusses the importance of broadening the context when assessing various new technologies and their effects. *Ed.*

[21] Woodwell and Mackenzie.

[22] Woodwell, "The Energy Cycle of the Biosphere."

The dysfunction of the biosphere results in an environment that is changing quickly and drastically at the very moment that we are reaching out to meet the needs of soaring human numbers and expectations. The consequences of such destruction for global, national, and individual personal security are no less threatening than those of war. Indeed, they are in fact a cause of war as the vise of environmental impoverishment closes. This trend will only intensify as larger swaths of once-fertile land become arid and water supply problems increase.

The global environmental squeeze is the global integration of specific local failures around the world. It is a clear sign that we need to look around ourselves, our lives, our houses, farms and municipalities and nations and re-adjust our activities and use of resources to conform to a set of standards that, when summed to the world as a whole, re-establishes a stable and sustainable biosphere. We must widen the context beyond our immediate neighborhoods. Re-establishing the dominance of natural ecosystems in management of the earth is a major task; but it is the only path that can work. Preserving the earth as a self-maintaining, regenerative living system is the emergent, essential objective. It is more important than war, for, failing, there is nothing worth fighting over. It is important enough to be a basis for challenging not only human activities but also inventions, technologies, and even dreams.

INTEGRITY OF EARTH AND HUMAN ACTION

There is ample precedent for such worldwide imperatives in law and in human affairs. It is unacceptable for example to murder one's fellow citizens by spreading mercury over the landscape, or to make children stupid by exposing them to lead, or to distribute DDT in the United States. It is a small step to move from protecting personal security from poisons distributed by one's neighbor, or by industry, to protecting the security of all by managing landscapes and regions to preserve their *physical, chemical and biotic integrity.* In fact, these very words have been a part of the objectives of every incarnation of the Water Pollution Control Act in the United States since 1972: *physical, chemical and biotic integrity.* It is difficult to exaggerate the importance of such "integrity."

The key elements to maintaining this integrity are energy and forests, and both demand attention now. In terms of energy, there is a clear connection to the present world crisis as the United States moves to protect its interests in access to Arabian oil and attempts to increase its own domestic production despite a lack of reserves. But the infatuation of the industrialized world with oil is a cause not only of climatic disruption, political instability, and bellicose bluster punctuated by occasional outbreaks of war but it is also the cause of a host of serious pollution problems such as the acidification of rain with oxides of sulfur and nitrogen. The threat to security is double-edged. There is an immediate economic threat if oil is cut off, and a slightly less immediate—but real and global and fatal—environmental threat if it is not. What is required is an awareness of long-term possibilities, not just short-term market incentives.

Forests are the second component to biospheric integrity. They are so large in the world in area, in carbon content, and in influence on global and local energy and water budgets, that we must think of them as the great biotic flywheel that keeps the biosphere functioning as a stable human habitat. Deforestation, the change in land use from forest to agriculture or, ultimately, barren land, contributes 1.6 to 2.0 billion tons of carbon annually to the total of about 8 billion tons released annually through human activities.

If we are to reduce carbon emission levels as much as the 3-4 billion tons mentioned above, we must pay attention to forests as well as fossil fuels, if only because forests are the natural vegetation of such a large fraction of the land area. Forests originally covered about 44% of all land. They have been reduced to about 28% now but still exert a very large influence on energy, water, and climate regionally and globally. The absolute protection of the earth's remaining primary forests, most of which lie in the tropics of Africa, in the Amazon Basin, Borneo and Siberia, is essential in moving toward controlling and stabilizing the composition of the atmosphere. Attention to forests is a feasible goal: restoration of deforested lands is a step in restoring the functional integrity of landscapes such as Haiti, as well as other impoverished and eroding drainage basins around the world. The efforts begin at home, but they ultimately sum to a biosphere that is either functional and has a future, or is progressively dysfunctional and a certain cause of continued political instability and spreading human misery.

While the world will see many causes of the immediate crises of environment and government and also many solutions, the ecologists are not mistaken in their recognition of a chain of dependencies between human welfare and the fundamental resources of air, water, land and a place to live. We expect our governments, at least in democratic societies, to establish and defend equity in access to those essential resources. Indeed, it is a core function of government. While the urge to stamp out terrorism is correct, there is always going to be desperate resentment in a world in which there continues to be an increasing and soaring differentiation of rich and poor, of haves and have nots, of equity and lack of equity in opportunity to live in safety and comfort under well-regulated laws. Despite the necessity for a major global effort in controlling and (if we are persistent and fortunate) eliminating terrorism, nothing has changed the urgency of addressing the decay of the human environment through climatic disruption and biotic impoverishment.

Our concern is long standing and consistent: climatic disruption through human-caused changes in the composition of the atmosphere will only provoke further troubles in the world. Integrity is needed in human action in order to restore integrity to the environment in which we all live and upon which we all depend. The environmental basis of this concern is rooted in science that has a century and more of research behind it. And there are, despite persistent critics, abundant recent data confirming the transitions and plentiful new insights into the global bioclimatic system.

Time is short. The world is already at levels of heat-trapping gases that will produce effects outside the realm of predictability and therefore outside the realm of acceptability or reasonable risk. The global transition of the 11th of September only makes the issue more urgent, not as some would have it, less.

CONCLUSION

We come to the objective: a massive shift away from fossil fuels, toward locally available renewable sources of energy, and toward the restoration of the functional integrity of land and water as essential to continued human habitation of the biosphere. Both are essential to human security and to the independence, self-sufficiency and security of individuals and nations.

The transition need not be immediate; it cannot be. It requires public leadership and, ultimately, governmental responsibility and support. But the opportunity to make that transition is here. It can start with a young and vigorous scientific community, just as the Framework Convention started with some scientific revolutionaries who held meetings around the world, and who ultimately persuaded the United Nations General Assembly to proceed with drafting a treaty which is now the law of the world.

Further, we need a new set of innovations to bring an immediate 20% reduction in use of fossil fuels nationally by the United States and other industrialized nations, and to advance the restoration of the functional integrity of the biosphere. The local, national and global responsibility of this generation is essential to ridding the world of all forms of terrorism, degradation and destruction.

All have been left reeling by recent violent events and the continued march of uncertain military and political sequelae. There is an overwhelming sense that we have experienced a major transition in the globalization of the human endeavor, and the urgency of the environmental transition has become only more pronounced. The decade of experience with the Framework Convention on Climate Change and the Kyoto Protocol, followed by the Johannesburg Summit, started with the momentum of one of the most promising treaties of all time. Yet it ended with a scandalous rejection of the Protocol by a new U.S. administration committed to the oil industry. While the official meetings in Johannesburg became virtually irrelevant under U.S. leadership, it became clear that the Kyoto Protocol will enter into force even without the U.S., and that the rest of the world is acutely aware of the emergence of the multiple crises of environmental degradation. A vigorous non-governmental community at Johannesburg captured the essence of the moment as a challenge to the scientific and political communities to advance a genuine revolution in the human undertaking, replacing *a strategy of failure* based on the corruption and impoverishment of the human habitat with a *strategy of hope* based on the biosphere's potentially infinite capacity for renewal and self-repair. The place to start is with the implementation of the intent and details of the Framework Convention on Climate Change, already the law of the world.

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